

# Overview of Duke ITk activities

US ATLAS ITk meeting

SLAC, July 7, 2015

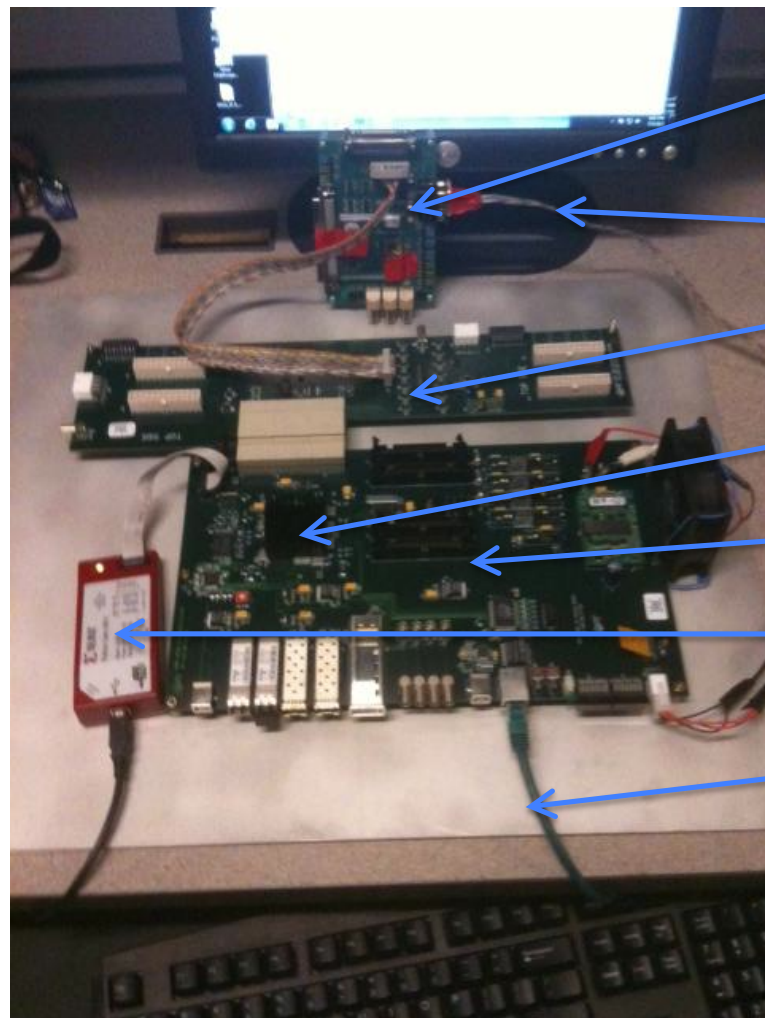
Mark Kruse

# Duke ITK Personnel and Funding

- **Faculty:** Ayana Arce, Mark Kruse
- **Technical support:** Brogan Thomas (0.8 FTE)
- **Postdocs:**
  - Enrique Kajomovitz (20%)
  - TBD (50%)
- **Grad students:**
  - Ping Zhao (100%, current qualification task)
  - Chen Zhou (50%, completed qualification task)
  - Doug Davis, Kevin Holway (20%, Qualification tasks on TRT SW)
- **Undergrads:** ~6 at any one time
- **Funding Support:**
  - US ATLAS (Brogan Thomas)
  - Duke DOE base grant (faculty, postdocs, grad students)
  - Undergrads (Duke)

**History:** started with HSIO test setup (with ABCn250 1-chip board) to gain experience with testing procedures/code

## The ATLAS silicon upgrade HSIO setup at Duke



Single ABCn chip board

Cable to PS

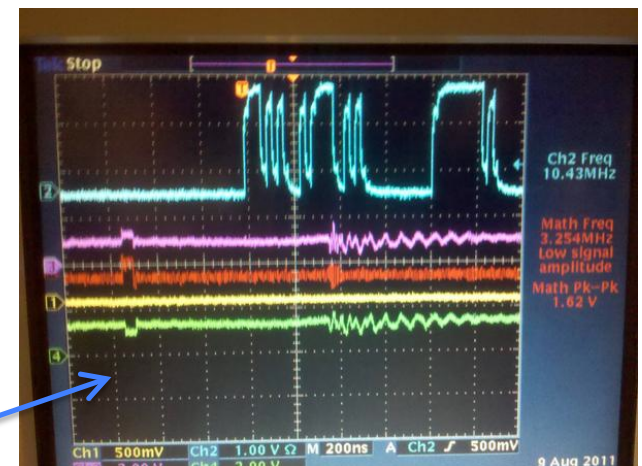
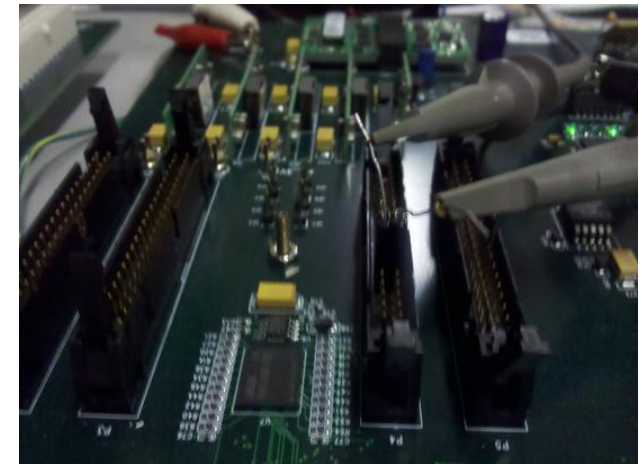
Interface board

Xilinx FPGA chip

HSIO board

Xilinx FPGA interface

Ethernet cable



Signals shown on a scope  
being sent to the ABCn chip

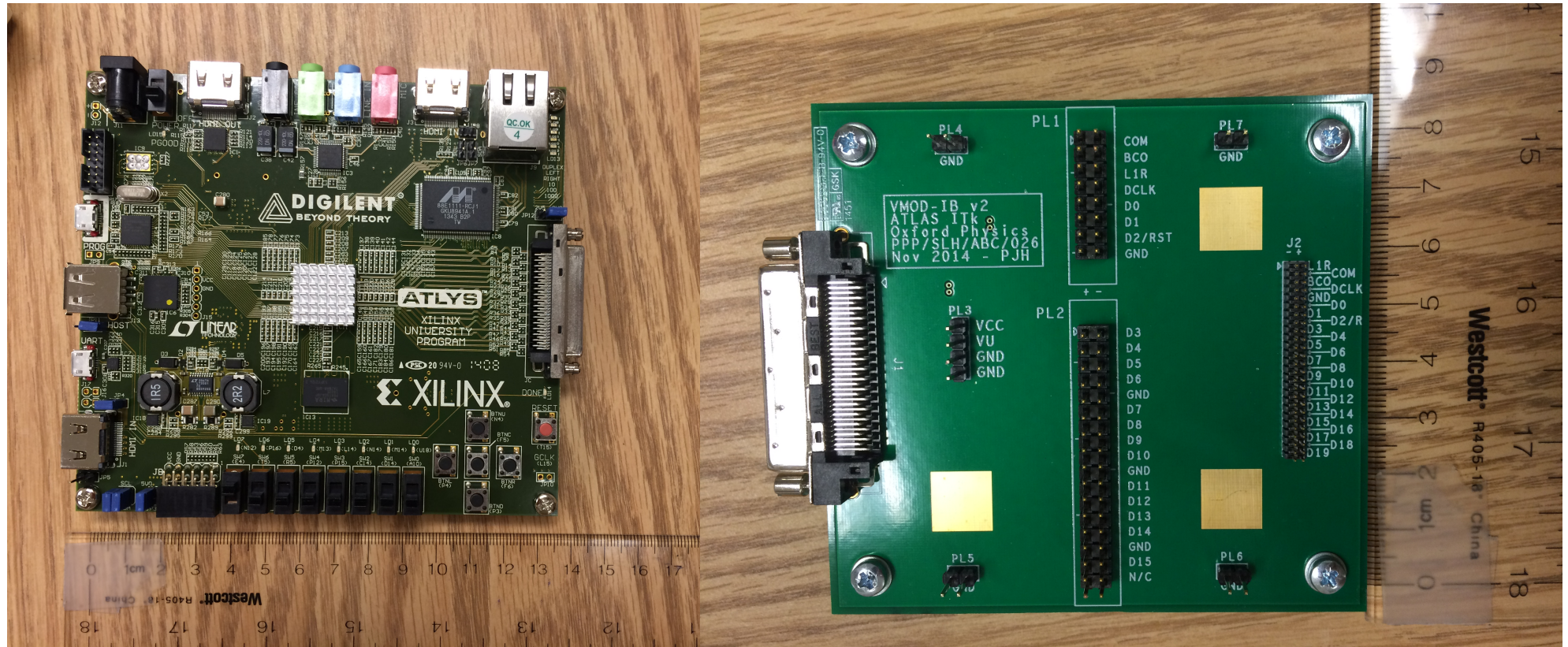
# Summary of current Duke activities (more details next slides)

- Developing Atlys setup
- Developing module testing infrastructure (cooling, etc.)
- Developing interlock system
- Working on simulations (for module testing, and separately in overall ITK simulation group)
- Coordinating SR1@CERN setup(s)



# HSIO → Atlys

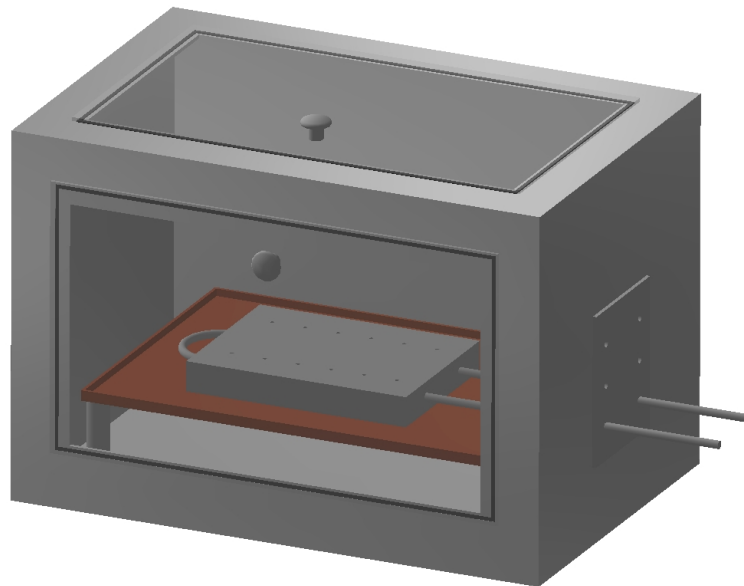
- We have purchased an Atlys board (\$280) and Peter Phillips (RAL) has sent us a VMOD-IB (and has helped us with setup)



- Ping Zhao (grad student) is working with UK (mostly Peter Phillips) to get this up and running at Duke
- Will need test parts (ABCn130) – on distribution list for these

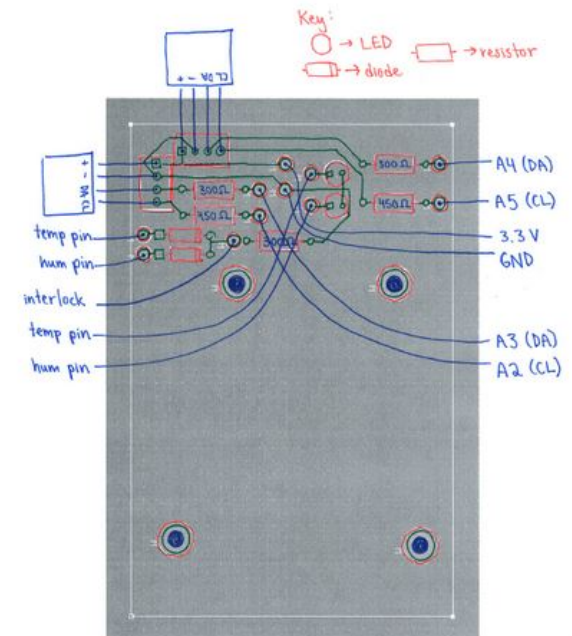
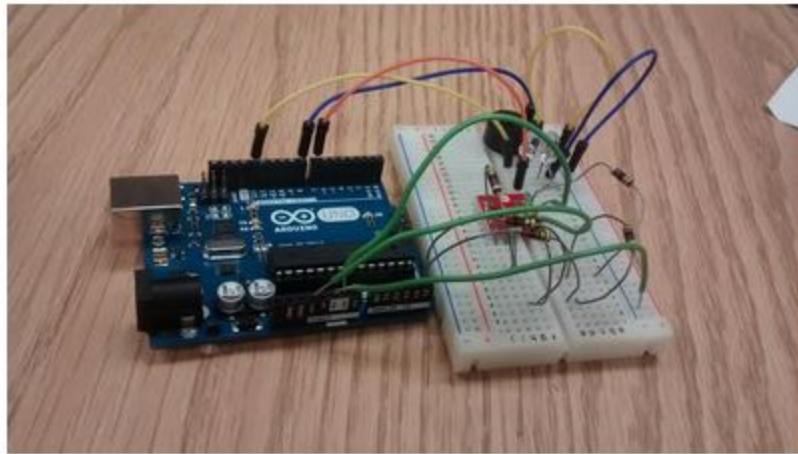
# Module testing

- In coordination with BNL, developing a “standardized” module testing setup that will be easy to replicate elsewhere:
  - Cooling system (want capability down to -40C)
    - Closing in on what chiller to use (Brogan, with Dave Lynn and Will Emmet)
  - Humidity control: dry air system
    - Looking into Puregas HR Series Regenerative Desiccant Air Dryer
    - Could also simply use nitrogen
  - Cooling block/support: can machine at Duke – drawings from UK
  - Module enclosure (being designed by Brogan Thomas)



# Module testing interlock system

- Modules are valuable – need to interlock on temp and perhaps humidity
- Undergrad project
- We have developed a simple Arduino based temperature and humidity monitoring system that can shut down module power when preset thresholds reached
- Requires PS with external input for interlocking



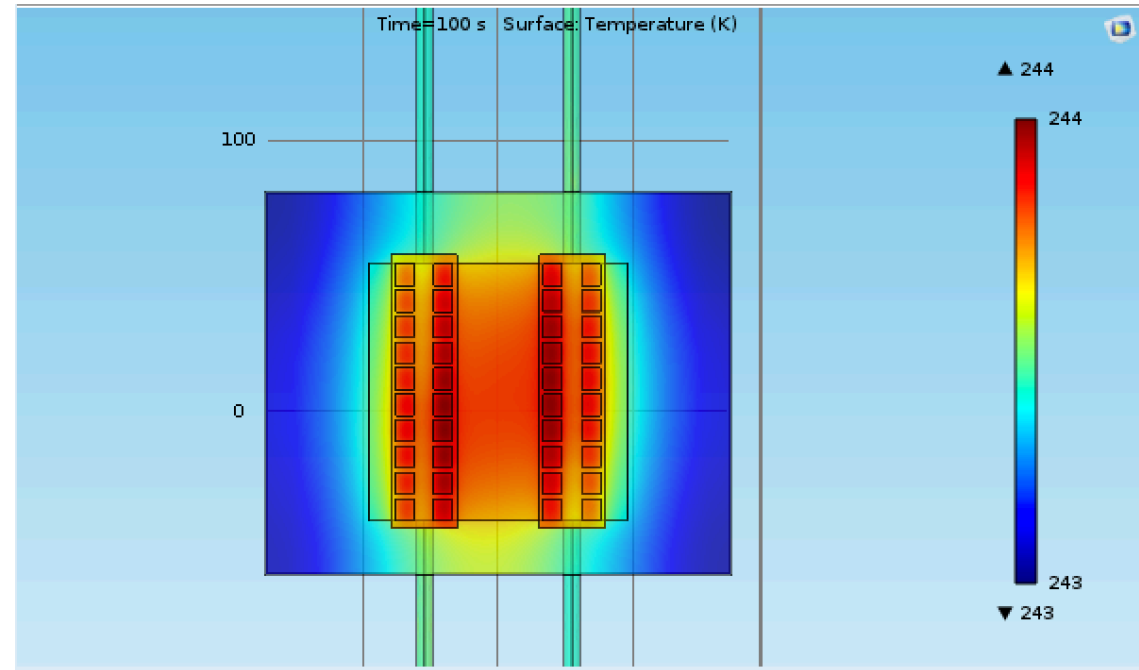
- Have just had PCB's printed and now putting it all together from bread-board model
- Total cost ~\$50



# Simulation studies

- **Module testing thermal simulations (Ping Zhao – grad student)**

- Useful for designing cooling and interlock system
- Here assume -30C into cooling block, total of 5W power, and various other assumptions



- **ITK simulation**

- We are involved in the ITK simulation group. As part of Chen Zhou's (grad student) qualification task he was studying different geometries, impact of pile-up and HL, and differences between full and fast simulation. This will be continued by new grad students



# Duke facilities

- **Duke Physics machine shop**
  - We have free shop time allotted to us, that mostly goes unused – we will machine some cooling blocks and module enclosures once design has been settled
- Possibility for B field stress tests at Duke
- We have access to the Duke SMIF (Machine and Instrumentation facility) which has a semi-automatic wirebonder, probe station, clean room (at any desired level) – however, probably only useful for repairs as/if needed

# Additional points

- We are working under the assumption that we can play a direct role in testing modules – in particular, various stress tests and perhaps burning-in in coordination with the labs, in addition to training personnel who can relocate to an ASC (for us at BNL and/or ANL)
- However, this model needs to be better defined, and the coordination between universities and labs more formally laid out
- We will also need access to test parts – we're on “the list” but they are hard to come by at the moment
- We're a small university group with limited resources: would be great to organise a conglomeration of similar groups coordinated through one of the labs (for us BNL)